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Comparative effects of blue light and red light on the rates of oxygen metabolism and heat production in wheat seedlings stressed by heat shock

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Abstract

The effect of blue light (BL, bandwidth 420–460 nm) and red light (RL, bandwidth 620–640 nm) on the rates of consumption and evolution of oxygen and rate of heat production of plants after action of high temperature (45 °C during 30 min) was studied. The rate of heat production was used as indicator of plant resistance to the action of unfavourable factors, since this index reflects the. physiological condition. The object of investigation were the seedlings of summer wheat. The blue light compared with red light had favourable effects on the rates of oxygen metabolism. The rate of O_2 evolution of wheat seedlings with blue light was higher by 50% (optimal temperature) and by 60% (after action 45 °C temperature) as seedlings with red light.

The rate of oxygen consumption of seedlings treated by high temperature with blue light was inhibited by 40–45% as control, whereas this index was decreased by 75% in plants after temperature shock with red light. Heat production rate of wheat seedlings grown in blue light was higher than the heat production rate of seedlings grown with red light.

Keywords: Blue and red light; Plant resistance; Heat production; Evolution and consumption oxygen; Microcalorimetry; Seedlings of summer wheat

1. Introduction

Light, being one of the most important factors of the environment, is not only an energetic substrate, but also is a regulator of the physiological processes in plants [1–4].

The literature covers the problems of influence of intensity and quality of light on photosynthesis [1,5–8]. But information about the role of light quality on other energetic and metabolic processes not associated with photosynthesis is lacking.

At present a conception about intercellular polyfunctional action of light as an important regulator of plant activity is developing [4]. It has been shown that the utilization of light energy takes place not only in chloroplast but in the different structures of plant cells. Many photoreceptors and organelles of intracellular membrane energy system participate in this process [4,8–10].

The aim of this work is to study blue and red light influence on the resistance of energetic processes of wheat seedlings to treatment by stress temperature.

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